

WHAT IS CLAIMED IS:

1. A planetary gear unit for an automatic transmission, comprising:

a sun gear;

a ring gear; and

a carrier which supports a pinion and with which a hub for a frictional engagement element is integrated and which is located on a radially outer side of the ring gear, wherein the carrier has one lateral plate and another lateral plate, both of said lateral plates supporting the pinion; and

the hub is formed integrally with the one lateral plate and axially overlaps the pinion, and at least one notch, having a circumferential length is equal to or longer than a diameter of the pinion, is formed in an outer periphery of the hub.

2. The planetary gear unit according to claim 1, wherein

a lubricating oil hole penetrates the one lateral plate radially inward from the notch.

3. The planetary gear unit according to claim 2, wherein

segments of an outer peripheral surface of the one lateral plate, between plural notches are formed as smooth surfaces.

4. The planetary gear unit according to claim 2, further comprising:

a support shaft for the pinion extending between the lateral plates, said lateral plates being axially spaced;

a longitudinal oil hole that extends axially through the support shaft;
a lateral oil hole in the support shaft which establishes communication between the longitudinal oil hole and an outer peripheral face supporting the pinion; and
a through-hole that extends radially through the support shaft at one end for supplying oil from the lubricating oil hole in the one lateral plate to the longitudinal oil hole, the support shaft being fixed to the one lateral plate at a position where the through-hole communicates with the lubricating oil hole.

5. The planetary gear unit according to claim 4, further comprising:

a pin inserted into the through-hole from a radially outer end of the lubricating oil hole and extending entirely through the through-hole, the support shaft being fixed to the one lateral plate by the pin, and the lubricating oil hole being plugged by the pin.

6. The planetary gear unit according to claim 5, wherein the sun gear has an axially extending boss portion and further comprising:

an oil sump formed in an inner peripheral face of the boss portion of the sun gear;
an oil hole extending through the boss portion, from the oil sump to an outer peripheral face of the boss portion, the one lateral plate being rotatably supported on the outer peripheral face of the boss portion at a position where the oil hole is radially aligned with the lubricating oil hole.

7. The planetary gear unit according to claim 6, in the form of a simple planetary gear unit constituting a forward-reverse switching unit for a continuously variable automatic transmission, wherein an input shaft is coupled to the ring gear and the sun gear is coupled to a primary pulley, said planetary gear unit further comprising:

a forward clutch interposed between the sun gear and the ring gear; and

a frictional engagement element serving as a reverse brake for selectively stopping the carrier.

8. The planetary gear unit according to claim 7, wherein

the forward clutch includes a clutch drum that couples the input shaft to the ring gear, a clutch hub integral with the sun gear, and multiple friction plates interposed between the clutch drum and the clutch hub,

the reverse brake includes multiple friction plates interposed between a hub extending axially from the one lateral plate and a case housing the planetary gear unit, and

the forward clutch and the reverse brake radially overlap.

9. The planetary gear unit according to claim 4, wherein the sun gear has an axially extending boss portion and further comprising:

an oil sump formed in an inner peripheral face of the boss portion of the sun gear;

an oil hole extending through the boss portion, from the oil sump to an outer peripheral face of the boss portion, the one lateral plate being rotatably supported on the outer peripheral face of the boss portion at a position where the oil hole is radially aligned with the lubricating oil hole.

10. The planetary gear unit according to claim 9, in the form of a simple planetary gear unit constituting a forward-reverse switching unit for a continuously variable automatic transmission, wherein an input shaft is coupled to the ring gear and the sun gear is coupled to a primary pulley, said planetary gear unit further comprising:

a forward clutch interposed between the sun gear and the ring gear; and

a frictional engagement element serving as a reverse brake for selectively stopping the carrier.

11. The planetary gear unit according to claim 10, wherein

the forward clutch includes a clutch drum that couples the input shaft to the ring gear, a clutch hub integral with the sun gear, and multiple friction plates interposed between the clutch drum and the clutch hub,

the reverse brake includes multiple friction plates interposed between a hub extending axially from the one lateral plate and a case housing the planetary gear unit, and

the forward clutch and the reverse brake radially overlap.

12. The planetary gear unit according to claim 2, wherein the sun gear has an axially extending boss portion and further comprising:

an oil sump formed in an inner peripheral face of the boss portion of the sun gear;

an oil hole extending through the boss portion, from the oil sump to an outer peripheral face of the boss portion, the one lateral plate being rotatably supported on the outer peripheral face of the boss portion at a position where the oil hole is radially aligned with the lubricating oil hole.

13. The planetary gear unit according to claim 12, in the form of a simple planetary gear unit constituting a forward-reverse switching unit for a continuously variable automatic transmission, wherein an input shaft is coupled to the ring gear and the sun gear is coupled to a primary pulley, said planetary gear unit further comprising:

- a forward clutch interposed between the sun gear and the ring gear; and
- a frictional engagement element serving as a reverse brake for selectively stopping the carrier.

14. The planetary gear unit according to claim 13, wherein

the forward clutch includes a clutch drum that couples the input shaft to the ring gear, a clutch hub integral with the sun gear, and multiple friction plates interposed between the clutch drum and the clutch hub,

the reverse brake includes multiple friction plates interposed between a hub extending axially from the one lateral plate and a case housing the planetary gear unit, and

the forward clutch and the reverse brake radially overlap.

15. The planetary gear unit according to claim 2, in the form of a simple planetary gear unit constituting a forward-reverse switching unit for a continuously variable automatic transmission, wherein an input shaft is coupled to the ring gear and the sun gear is coupled to a primary pulley, said planetary gear unit further comprising:

- a forward clutch interposed between the sun gear and the ring gear; and
- a frictional engagement element serving as a reverse brake for selectively stopping the carrier.

16. The planetary gear unit according to claim 15, wherein

the forward clutch includes a clutch drum that couples the input shaft to the ring gear, a clutch hub integral with the sun gear, and multiple friction plates interposed between the clutch drum and the clutch hub,

the reverse brake includes multiple friction plates interposed between a hub extending axially from the one lateral plate and a case housing the planetary gear unit, and

the forward clutch and the reverse brake radially overlap.

17. The planetary gear unit according to claim 1, further comprising:

a support shaft for the pinion extending between the lateral plates, said lateral plates being axially spaced;

a longitudinal oil hole that extends axially through the support shaft;

a lateral oil hole in the support shaft which establishes communication between the longitudinal oil hole and an outer peripheral face supporting the pinion; and

a through-hole that extends radially through the support shaft at one end for supplying oil from the lubricating oil hole in the one lateral plate to the longitudinal oil hole, the support shaft being fixed to the one lateral plate at a position where the through-hole communicates with the lubricating oil hole.

18. The planetary gear unit according to claim 17, further comprising:

a pin inserted into the through-hole from a radially outer end of the lubricating oil hole and extending entirely through the through-hole, the support shaft being fixed to the one lateral plate by the pin, and the lubricating oil hole being plugged by the pin.

19. The planetary gear unit according to claim 1, in the form of a simple planetary gear unit constituting a forward-reverse switching unit for a continuously variable automatic transmission, wherein an input shaft is coupled to the ring gear and the sun gear is coupled to a primary pulley, said planetary gear unit further comprising:

a forward clutch interposed between the sun gear and the ring gear; and

a frictional engagement element serving as a reverse brake for selectively stopping the carrier.

20. The planetary gear unit according to claim 19, wherein

the forward clutch includes a clutch drum that couples the input shaft to the ring gear, a clutch hub integral with the sun gear, and multiple friction plates interposed between the clutch drum and the clutch hub,

the reverse brake includes multiple friction plates interposed between a hub extending axially from the one lateral plate and a case housing the planetary gear unit, and

the forward clutch and the reverse brake radially overlap.

21. A continuously variable automatic transmission comprising:

a primary pulley;

a secondary pulley;

a belt through which the primary pulley drives the secondary pulley;

a forward-reverse switching unit comprising:

a sun gear coupled to the primary pulley;

a ring gear;

a carrier which supports a pinion and with which a hub for a frictional engagement element is integrated and which is located on a radially outer side of the ring gear, wherein

the carrier has one lateral plate and another lateral plate, both of said lateral plates supporting the pinion;

the hub is formed integrally with the one lateral plate and axially overlaps the pinion, and at least one notch, having a circumferential length equal to or longer than a diameter of the pinion, is formed in an outer periphery of the hub;

an input shaft coupled to the ring gear;

a forward clutch interposed between the sun gear and the ring gear; and

a reverse brake for selectively stopping the carrier.

22. The continuously variable automatic transmission according to claim 21, wherein
a lubricating oil hole penetrates the one lateral plate radially inward from the notch.

23. The continuously variable automatic transmission according to claim 22, further comprising:

a support shaft for the pinion extending between the lateral plates, said lateral plates being axially spaced;

a longitudinal oil hole that extends axially through the support shaft;

a lateral oil hole in the support shaft which establishes communication between the longitudinal oil hole and an outer peripheral face supporting the pinion; and

a through-hole that extends radially through the support shaft at one end for supplying oil from the lubricating oil hole in the one lateral plate to the longitudinal oil hole, the support shaft

being fixed to the one lateral plate at a position where the through-hole communicates with the lubricating oil hole.

24. The continuously variable automatic transmission according to claim 23, further comprising:

a pin inserted into the through-hole from a radially outer end of the lubricating oil hole and extending entirely through the through-hole, the support shaft being fixed to the one lateral plate by the pin, and the lubricating oil hole being plugged by the pin.

25. The continuously variable automatic transmission according to claim 24, wherein the sun gear has an axially extending boss portion and further comprising:

an oil sump formed in an inner peripheral face of the boss portion of the sun gear;

an oil hole extending through the boss portion, from the oil sump to an outer peripheral face of the boss portion, the one lateral plate being rotatably supported on the outer peripheral face of the boss portion at a position where the oil hole is radially aligned with the lubricating oil hole.